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SIST EN 27243:2001

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EUROPEAN STANDARD

EN 27243

NORME EUROPÉENNE

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Descriptors: Human factors engineering, work safety, operating stations, human body, thermal comfort, environmental tests, climatic conditions, heat, thermal measurements

English version

**Hot environments - Estimation of the heat stress
on working man, based on the WBGT-index (wet
bulb globe temperature) (ISO 7243:1989)**

Ambiances chaudes - Estimation de la contrainte thermique de l'homme au travail, basée sur l'indice WBGT (température humide et de globe noir) (ISO 7243:1989)

Warmes Umgebungsklima - Ermittlung der Wärmebelastung des arbeitenden Menschen mit dem WBGT-Index (wet bulb globe temperature) (ISO 7243:1989)

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

The European Standards exist in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

Page 2
EN 27243:1993

Foreword

This European Standard is the endorsement of ISO 7243:1989. Endorsement of ISO 7243 was recommended by Technical Committee CEN/TC 122 "Ergonomics" under whose competence this European Standard will henceforth fall.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 1994, and conflicting national standards shall be withdrawn at the latest by April 1994.

The standard was approved and in accordance with the CEN/CENELEC Internal Regulations, the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom.

Endorsement notice

The text of the International Standard ISO 7243:1989 was approved by CEN as a European Standard without any modification.

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INTERNATIONAL STANDARD

ISO 7243

Second edition
1989-08-01

Hot environments — Estimation of the heat stress on working man, based on the WBGT-index (wet bulb globe temperature)

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(standards.iteh.ai)

*Ambiances chaudes — Estimation de la contrainte thermique de l'homme au travail,
basée sur l'indice WBGT (température humide et de globe noir)*

[SIST EN 27243:2001](https://standards.iteh.ai/catalog/standards/sist/689994d4-424c-4a65-8b6b-26b44409036d/sist-en-27243-2001)

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26b44409036d/sist-en-27243-2001](https://standards.iteh.ai/catalog/standards/sist/689994d4-424c-4a65-8b6b-26b44409036d/sist-en-27243-2001)



Reference number
ISO 7243 : 1989 (E)

ISO 7243 : 1989 (E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 7243 was prepared by Technical Committee ISO/TC 159, *Ergonomics*.

This second edition cancels and replaces the first edition (ISO 7243 : 1982), of which it constitutes a minor revision.

Annexes A to D of this International Standard are for information only.

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Introduction

This International Standard is one of a series (listed in annex D) intended for use in the study of thermal environments.

The aim of this series of International Standards is in particular

- the finalization of definitions for terms to be used in methods of measurement, test and interpretation, taking into account those standards already existing or which are being drafted;
- the drafting of specifications relating to the methods of measurement for physical parameters characterizing thermal environments;
- the selection of one or more methods of interpretation of the parameters;
- the establishment of recommended or maximum values for exposure to thermal environments in the regions of comfort and extreme environments (hot and cold);
- the drafting of specifications relating to the methods of measurement of the efficiency of devices or procedures for individual or collective protection against heat and cold.

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In the light of the increasing interest being shown in the problems presented by the exposure of individuals to thermal environments and the fact that there are few documents or national standards in this field, it seemed desirable to publish this International Standard, without waiting for the complete series to be drafted.

The wet bulb globe temperature (*WBGT*) index is one of the empirical indices representing the heat stress to which an individual is exposed. This index is easy to determine in an industrial environment. The method for evaluating the heat stress based on this index is a compromise between the desire to use a very precise index and the need to be able to carry out control measurements easily in an industrial environment. It should be regarded as an exploratory method.

A method of estimating the thermal stress based on an analysis of the heat exchange between man and environment allows a more accurate estimation of stress and an analysis of the methods of protection. But with the present technology of measurement, the method has the drawback of being longer and more difficult to undertake. Such a method will therefore be used either directly when it is desired to carry out an intensive analysis of working conditions in heat, or in addition to the method based on the *WBGT* index when the values obtained using the first approach exceed the reference values shown.

Establishing a method of evaluating heat stress based on the *WBGT* index is only one step towards the definition of an index showing the advantages of both methods together. However, as there is no such index at present it seemed advisable to encourage immediately the development of an International Standard capable of being used in an industrial environment.

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Hot environments — Estimation of the heat stress on working man, based on the *WBGT*-index (wet bulb globe temperature)

1 Scope

This International Standard gives a method, which can easily be used in an industrial environment, for evaluating the heat stress to which an individual is subjected in a hot environment and which allows a fast diagnosis.

It applies to the evaluation of the mean effect of heat on man during a period representative of his activity but it does not apply to the evaluation of heat stress suffered during very short periods, nor to the evaluation of heat stresses close to the zones of comfort.

- Outside buildings with solar load :

$$WBGT = 0,7 t_{nw} + 0,2 t_g + 0,1 t_a$$

This method of estimating heat stress is based on the measurement of these different parameters and the calculation of mean values taking into account any space-time variations of these parameters.

The data collected and dealt with in this way are compared with the reference values and then it is necessary

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- either to reduce directly the heat stress or strain at the work-place by appropriate methods;

- or to carry out a detailed analysis of the heat stress using methods that are more elaborate but are also usually longer and more difficult to apply.

2 Principle and general definition

The heat stress to which a person exposed to a hot environment is subjected is, in particular, dependent on the production of heat inside the body as a result of physical activity and the characteristics of the environment governing heat transfer between the atmosphere and the body.

The internal thermal load is the result of metabolic energy caused by activity.

A detailed analysis of the influence of the environment on heat stress requires a knowledge of the following four basic parameters: air temperature, mean radiant temperature, air speed, and absolute humidity.^[3] However, an overall estimation of this influence can be made by measuring parameters derived from these basic parameters and which are a function of the physical characteristics of the space used.

The *WBGT* index combines the measurement of two derived parameters, natural wet-bulb temperature (t_{nw}) and the globe temperature (t_g) and in some situations, the measurement of a basic parameter, air temperature (t_a) (dry bulb temperature). The following expressions show the relationship between these different parameters :

- Inside buildings and outside buildings without solar load :

$$WBGT = 0,7 t_{nw} + 0,3 t_g$$

These reference values correspond to levels of exposure to which, under the conditions specified in annex A, almost all individuals can be ordinarily exposed without any harmful effect, provided that there are no pre-existing pathological conditions.

Moreover, the fixing of these levels of exposure in relation to the health of the individual in no way prejudices those which might possibly be fixed for other important reasons such as the alteration of psychosensorimotor reactions likely to cause accidents at work.

3 Measurement of parameters characteristic of the environment

Measurement of the *WBGT* index necessitates the measurement of two derived parameters, natural wet bulb temperature and globe temperature and the measurement of a basic parameter, air temperature.

3.1 Measurement of derived parameters

The information supplied by the sensor for measuring the derived parameters is always dependent on the physical characteristics of the sensor used, all things being equal. These characteristics are specified in 3.1.1 and 3.1.2.